



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Migliorini et al.

Examiner: Keehan, C.

Serial No.: 09/879,448

Group Art Unit: 1712

Filed: June 12, 2001

Docket: 2001B056

For: IMPROVED METHOD FOR
PREPARING SEALABLE
FILMS WITH SILOXANE
ADDITIONS

Dated: August 7, 2002

Commissioner for Patents
Washington, DC 20231

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DECLARATION UNDER 37 C.F.R. §1.132

Sir:

I, Robert A. Migliorini, declare as follows:

1. I am one of the inventors of the above-referenced patent application.
2. I have worked in the Films Division of ExxonMobil Chemical Corporation (formerly Mobil Oil Corporation) for more than fourteen (14) years and have held a variety of positions in the research and development and manufacturing groups. For the past two (2) years, I have worked in the manufacturing group and my current title is Plant Manager. I have extensive knowledge in the development and manufacture of thermoplastic films and the polymeric materials that are used to form such films. I have a bachelor's degree in Chemical Engineering from Tufts University and a master's degree in materials engineering from Rochester Institute of Technology and I have taken a number of courses relating to thermoplastic film technology.

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3. The present invention relates to surface-treatable thermoplastic films, and methods to produce the same, which exhibit surprisingly good slip properties. Particularly, these films surprisingly combine the properties of good printability and good heat sealability with good slip properties. It has been unexpectedly discovered herein that this combination of properties is achieved by the incorporation of silicon additives into the transition layers, i.e. tie layers, of these films.

Incorporation of additives into tie layers to confer good slip properties would have been unexpected at time of the present invention. Tie layers are conventionally used for joining two chemically dissimilar resin layers.

The surfaces of these films can be treated since there is no silicon in, or on, the skin layers during the production and/or processing of these films. After processing, the silicon additives from the tie layer migrate through the skin layer to the surface of the skin layer. Accordingly, the coefficient of friction of the skin layer is reduced, thus providing good slip properties. The rate of migration of the silicon additives is significantly dependent upon the viscosity of the silicon. Silicon gum is an example of a viscous silicon which would exhibit a slow rate of migration.

4. One of the novel features of the films of the present invention is the coexistence of a high seal strength, good surface treatability (which allows good surface wettability), and a low coefficient of friction through the use of a silicon based slip system in thermoplastic films. A skilled artisan would not have expected that such properties would appear together in a sealable surface-treated film containing silicon additive, at the time of the present invention.

All commercial embodiments of silicon slip systems incorporate silicon into the skin layer. When a sealable skin layer containing silicon additive is subjected to flame, corona, or plasma surface treatment, sealability is lost and the beneficial effect of silicon additive on lowering coefficient of friction is negated. Accordingly, the film is rendered non-functional for packaging applications requiring the combination of good surface wettability, good sealability and low coefficient of friction. (Surface-treated film with silicon additive incorporated in the

skin layer does not have a seal strength of at least about 200 grams per inch and does not have a coefficient of friction of at most about 0.65.)

For this reason, silicon additive is typically incorporated into a sealable skin layer that will not be subjected to surface treatment so that sealability and low coefficient of friction are obtained. However, surface wettability necessary for printability and other converting processes is not achieved due to the absence of a surface treatment step.

5. The polypropylenes used in the core layer of the films in the present invention are conventional polypropylenes. That is, the polymerization of the propylenes was catalyzed in the presence of Zeigler-Natta catalysts. An example of a specific polypropylene used is ATOFINA 3371.

By polymerizing propylenes in the presence of Zeigler-Natta catalysts, particular structural features are conferred to the resulting polypropylenes. These conventional polypropylenes have a mean isotactic block length of about 10 to about 20. Also, these polypropylenes have an n-heptane-soluble fraction of about 6 to about 8, based on the weight of the starting polymer. Additionally, the molecular weight distribution of these polypropylenes is comparatively broad. That is, the ratio of the weight average M_w to the number average M_n is from about 5 to 12, with a mean of about 7.

6. The polypropylenes used in the core layer of the films disclosed in Peiffer et al. are unconventional polypropylenes. That is, the polymerization of the propylenes was catalyzed in the presence of metallocene catalysts. The polypropylenes resulting from such polymerization differ substantially in structure from conventional polypropylenes.

Such structural characteristics include a mean isotactic block length between two structural chain defects of at least 40, more typically of at least 60, and most typically of at least 70 propylene units. Another structural characteristic of the polypropylene is a particularly low n-heptane-soluble fraction. This fraction is generally less than 1.0% by weight, based on the weight of the starting polymer. Such a fraction cannot be provided by using Ziegler-Natta

catalyst systems due to lack of sufficient stereospecificity inherent to such catalyst systems. Additionally, the molecular weight of the polypropylene is comparatively narrow. That is, the ratio of the weight average M_w to the number average M_n is less than 4, more typically less than 3.

7. The polypropylenes disclosed by Crass et al. (U.S. Patent No.: 4,502,263) and Bothe et al. (U.S. Patent No.: 4,734,317) are conventional polypropylenes. That is, propylenes were polymerized in the presence of Ziegler-Natta catalysts.

When the patents of Crass et al. and Bothe et al. were filed (December 16, 1983 and March 5, 1986, respectively), metallocene catalysts were not known, let alone used to polymerize propylene.

8. I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true. Further that these statements were made with the knowledge that willfully false statements, and the like, so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willfully false statements may jeopardize the validity of the application of any patent issued thereon.



Robert Migliorini